REMARKS

Applicants have carefully reviewed and considered the Examiner's Action mailed March 28, 2008. Reconsideration is respectfully requested in view of the comments set forth below.

35 U.S.C. § 103(a) Rejection based on Harano et al., Ichikawa et al. and Shintani et al.

Claims 1 and 2 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,009,922 to Harano et al. (hereinafter referred to as "Harano") and further in view of JP 3163868 to Ichikawa et al. (hereinafter referred to as "JP'868") and JP 4350157 to Shintani et al. (hereinafter referred to as "JP'157"). This rejection is respectfully traversed.

Harano is directed to a method of forming a transparent conductive film using an arc discharge type plasma generated in an atmosphere wherein the pressure of an atmospheric gas is 3.0×10^{-4} or higher, and the plasma is converged onto a vapor deposition material whereby the transparent conductive film is formed on a substrate located above the vapor deposition material. See column 2, lines 37-48 of Harano. As the Examiner acknowledges Harano fails to teach the recited features of repeatedly supplying stepwise increased electric power and "sequentially moving and expanding the plasma from a first plasma region up to a maximum plasma region to sequentially melt the unmelted portion" of a vaporizing material, as recited in method claim 2. With respect to the production device of claim 1, Harano "does not teach the other limitations of claim 1": the recited sequentially increased electric power supply unit and the plasma control unit, which sequentially melt and evaporate an unmelted portion of raw material. In fact, Harano expressly teaches that vapor deposition substrate 6 on which the film is formed is heated by RF voltage 8 (Figure 1, column 4, lines 40-44 of Harano), while a battery 7 applies voltage across the plasma gun 1 and hearth 4 (column 4, lines 35-40 of Harano).

As described in paragraphs [0004]-[0006] of the originally-filed application, when two or more sorts of metal elements with different melting points, such as Al and Ti are melted in the same crucible, the obtained film contains a high ratio of the low-melting material on the base side and a high ratio of the high-melting material toward the surface layer thereby resulting in a film with an inconsistent composition. The claimed invention solves this problem by sequentially melting and evaporating the raw material comprising at least two sorts of metals or intermetallics compound from a single crucible or hearth.

The secondary references to JP'868 and JP'157 do not teach or suggest the claimed feature of "sequentially moving and expanding the plasma from a first plasma region up to a maximum plasma region to sequentially melt the unmelted portion", as recited in independent claims 1 and 2 of the present application. It is the Examiner's position that the two films produced by JP'868 meets the recited claim language of "sequentially moving and expanding the plasma from a first plasma region up to a maximum plasma region to sequentially melt the unmelted portion". However, the Constitution of JP'868 states that "variations in reflected power are reduced when the film forming is resumed, hence the plasma is **stablilized**". In addition, the primary reference of Harano fails to disclose the recited vaporizing material of an alloy containing at least two sorts of metals or intermetallics compound, as column 1 of Harano discloses single metal oxides.

Contrary to the claimed invention, JP'868 discloses high frequency excited plasma which produces an initial film layer while the supply power is increased to the desired power and then a normal film layer is formed on the initial film layer while the desired power is supplied. See Constitution of JP'868. Thus, JP'868 is providing two different layers of a film, which the claimed invention avoids. There is no disclosure in JP'868 of sequentially melting raw material,

let alone moving and expanding the plasma from a first region up to the maximum plasma region, as recited in claims 1 and 2 of the present application. Consequently, it is submitted that any combination of Harano and JP'868 would not reasonably result in "moving and expanding the plasma from the first plasma region up to maximum plasma region **to sequentially melt the unmelted portion** [of the vaporizing material]" (emphasis added), as recited in device claim 1 and method claim 2 of the present application.

Contrary to Harano, JP'868 describes an embodiment employing a high frequency excited plasma ion plating apparatus for deposition. An ion plating process is described in JP'868 as "a method of forming a transparent conductive film on a substrate by forming high frequency excited plasma to react with evaporated particles from an evaporation source or target with oxygen gas introduced in the ambient atmosphere". The high frequency plasma is thus used for encouraging or facilitating the reaction of evaporated particles and the ambient gas and not for melting raw material, as claimed by Applicants. The attached Ion Plating Reference Material from the Japanese Patent Office disclose that ion plating is the combination of vacuum deposition and plasma where the plasma of reactive gas is mixed with evaporated particles to form a compound film. In other words, the teaching of increasing RF power according to JP'868 has nothing to do with melting and evaporating raw material, but with reducing the variations in reflected power when the film forming is resumed (region 3 of Figure 2 - plasma is stablilized).

The use of JP'868, as described in the attached Abstract from Dialog is to form a transparent electro-conductive thin film on a substrate without producing the white turbidity of the thin film, and reducing scattering of resistivity of the thin film. Neither the Dialog Abstract nor the English language Patent Abstract of Japan attached to JP'868 indicate any disclosure that a sequentially increased electric power supply unit supplies first power to evaporate the

vaporizing material and then applies electric power increased stepwise from the first electric power at predetermined intervals repeatedly up to the necessary maximum electric power to sequentially melt an unmelted portion of vaporizing material, as recited in claims 1 and 2 of the present application.

Like Harano and JP'868, JP'157 also fails to disclose a device or method of producing a film formed "from a vaporizing material of an alloy containing at least two sorts of metals or intermetallics compound". JP'157 discloses providing a PVD device capable of producing a thin film vapor deposited on a substrate surface with uniform **thickness**. Thus, JP'157 is not concerned with the problem faced by Applicants: improving the consistency of the composition of a thin film made by at least two metals or intermetallics compound.

The Applicants submit this translation of paragraph [0006] of JP'157:

> Uniformity of the film thickness can be improved by densely concentrating plasma to the portion of a crucible corresponding to a substrate portion where the film thickness becomes thin while roughly converging the plasma to a crucible portion corresponding to a substrate portion where the film thickness becomes thick.

There is no mention of an unmelted portion of the raw material during the process disclosed by JP'157. Thus, JP'157 is only concerned with uniformity of film thickness and is clearly remote from the recited plasma control for "continuously and sequentially moving and expanding plasma ... to sequentially melt the unmelted portion" of a vaporizing material containing at least two metals or intermetallic compounds, as recited in independent device claim 1 and independent method claim 2. It is submitted that one of ordinary skill in the art working with two different types of metals or intermetallics compound would not have considered JP'157, either alone or in combination with JP'858, to modify Harano so that both the electric power supply unit sequentially increases electric power in a stepwise fashion to sequentially melt an unmelted

portion of the material and the plasma control unit, simultaneously, "converges the plasma into a first plasma region necessary to evaporate the vaprorizing material and performs plasma control for continuously and sequentially moving and expanding the plasma from the first plasma region up to the maximum plasma region to sequentially melt the unmelted portion" of the vaporizing material, as recited in the independent claims of the present application.

As explained in the Background Art (paragraphs [0002]-[0005], in an ion plating or vacuum deposition process using a crucible as an evaporation source, it is common knowledge or practice to melt all raw metal in the crucible, and then, evaporate the raw material in the plasma. Since none of the applied references: Horan, JP'868, JP'157, discloses that the electrical power is increased stepwise to sequentially melt an unmelted portion of the vaporizing material, or, that the plasma is controlled (simultaneously with the increased power supply in method claim 2) to sequentially melt an unmelted portion of the vaporizing material, it is believed that the claimed invention of intentionally **sequentially melting** "an unmelted portion of the [raw] material" during the process is novel and inventive. Thus, it is submitted that one of ordinary skill in the art exercising commonsense would not combine the teachings of JP'868 and JP'157 with the primary reference to Harano to achieve in the claimed invention. None of the applied references, even if combined in the manner suggested by the Office Action, disclose or teach the recited feature of repeatedly supplying electric power increased stepwise, and continuously and sequentially moving and expanding plasma to sequentially melt an unmelted portion of raw material as required in the independent claims of the present application. Withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

35 U.S.C. §103(a) Rejection based on Harano, JP'868 and JP'157 in view of Shima et al.

Claim 3 was rejected under 35 U.S.C. §103(a) as being unpatentable over Harano, JP'868 and JP'157 and further in view of JP 2001001202 to Shima et al. (hereinafter referred to as JP'202). This rejection is respectfully traversed.

Claim 3 is directed to a coating tool including a cutting tool base material and a film formed according to the process set forth in claim 2. That is, claim 3 is dependent upon claim 2 and requires all the recited features of that claim. Since none of the applied references, as argued above, disclose the claimed combination of repeatedly supplying stepwise increased electric power and "sequentially moving and expanding the plasma from a first plasma region up to a maximum plasma region" in order to form the claimed multicomponent film, it is submitted that one of ordinary skill in the art would not have expected the claimed invention to be achieved by combining the above argued combination with a reference disclosing a film of nitride, carbonitride, nitroboride, carbonnitride or the like of Ti and Al to improve cutting. There is no disclosure of the recited features: repeatedly supplying stepwise increased electric power and "sequentially moving and expanding the plasma from a first plasma region up to a maximum plasma region" in JP'202. Accordingly, JP'202 cannot cure the missing features recited from the claims of the present application. Withdrawal of this rejection is requested.

In view of the foregoing comments, the prior art references do not render the claimed invention obvious, even when combined because none of the references discloses sequentially melting the raw material, let alone the recited features of using stepwise increased power and the convergence of the plasma from a first region to a maximum region to sequentially melt an unmelted portion of the raw material. Thus, it is believed that claims 1-3 are not rendered obvious, as they are patentably distinguished from the cited art, as argued above. Accordingly, it

is respectfully requested that a Notice of Allowance be issued indicating that claims 1-3 are allowed over the prior art of record.

Should the Examiner believe that a conference would advance the prosecution of this application, the Examiner is encouraged to telephone the undersigned counsel to arrange such a conference.

Respectfully submitted,

Date: June 27, 2008

Catherine M. Voorhees
Registration No. 33,074
VENABLE LLP
P.O. Box 34385
Washington, D.C. 20043-9998
Telephone: (202) 344-4000
Telefax: (202) 344-8300

CMV/elw
::ODMA\PCDOCS\DC2DOCS1\966264\1

POWERED BY Dialog

Dialog eLink: Order File History

Transparent electroconductive thin film prodn. - involves forming prim. layer using excitation plasma formed at reduced power than increasing power supply
Patent Assignee: TOYOTA JIDOSHA KK
Inventors: ICHIKAWA S; NAGAMI T; SHIMIZU T; YONEKURA Y

Patent Family (1 patent, 1 country)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
JP 3193868	A	19910823	JP 1989331680	A	19891221	199140	B

Priority Application Number (Number Kind Date): JP 1989331680 A 19891221

Alerting Abstract: JP A

Thin film is formed on a substrate under hf excitation plasma created from a controlled source power, in which at the initial stage of the film formation, an incipient film layer is formed on the substrate surface by setting the source power lower than objective power, then main film layer is formed on the incipient film layer using the objective power.

USE - Used for forming transparent electroconductive thin film without producing white turbidity of the thin film, and reducing scattering of resistivity of the thin film. @(5pp Dwg.No 0/4)

International Patent Classification

IPC	Level	Value	Position	Status	Version
C23C-0014/08	A	I	L	R	20060101
C23C-0014/24	A	I	L	R	20060101
C23C-0014/32	A	I	F	R	20060101
C23C-0014/34	A	I	L	R	20060101
C23C-0014/08	C	I	L	R	20060101
C23C-0014/24	C	I	L	R	20060101
C23C-0014/32	C	I	F	R	20060101
C23C-0014/34	C	I	L	R	20060101

Original Publication Data by Authority

Japan
Publication Number: JP 3193868 A (Update 199140 B)
Publication Date: 19910823
FORMATION OF THIN FILM
Assignee: TOYOTA MOTOR CORP (TOYT)
Inventor: ICHIKAWA SHOICHI SHIMIZU TATSUHIKO NAGAMI TETSUO YONEKURA YOKO
Language: JA
Application: JP 1989331680 A 19891221 (Local application)

Original IPC: C23C-14/32
Current IPC: C23C-14/08(R,I,M,JP,20060101,20051220,A,L) C23C-14/08(R,I,M,JP,20060101,20051220,C,L) C23C-14/24(R,I,M,JP,20060101,20051220,A,L) C23C-14/24(R,I,M,JP,20060101,20051220,C,L) C23C-14/32(R,I,M,JP,20060101,20051220,A,F) C23C-14/32(R,I,M,JP,20060101,20051220,C,F) C23C-14/34(R,I,M,JP,20060101,20051220,A,L) C23C-14/34(R,I,M,JP,20060101,20051220,C,L)

Derwent World Patents Index

Dialog® File Number 351 Accession Number 5680170

その他参考情報

1－6－3 イオンプレーティング

【技術分類】

1－6 真空蒸着装置

【技術の名称】

1－6－3 イオンプレーティング

【技術内容】

イオンプレーティングは、真空蒸着とプラズマの複合技術である。イオンプレーティングは、原則としてガスプラズマを利用して、蒸発粒子の一部をイオンもしくは励起粒子とし、活性化して蒸着する技術である。したがって反応ガスのプラズマを利用して蒸発粒子と結合させ、化合物膜を合成させる反応性イオンプレーティングが極めて有効である。プラズマ中の操作であるため、安定なプラズマを得るのが第1条件であり、低ガス圧の領域での弱電離プラズマによる低温プラズマを用いる場合が多い。

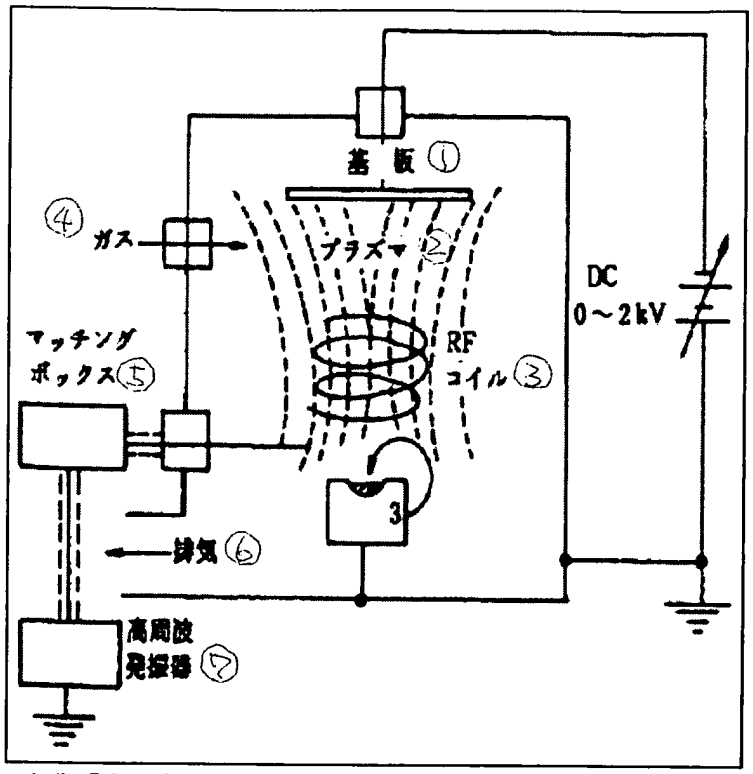
図1にイオンプレーティング装置の構造を示す。イオンプレーティング装置の特徴は、放電によるプラズマ発生装置と蒸発源を兼ね備えていることである。放電を起こす手段から、直流励起型と高周波励起型に大別されるが、ほかに蒸発機構にホローカソード、イオンビームを用いる装置もある。

図2にイオンプレーティング装置の製品例を示す。この装置にはプラズマビーム源が組み込まれ、高密度・高効率の電子ビーム励起プラズマを利用した成膜を行うことができる。特に、厳しい条件化で使用されるミラーや光学フィルタなどの光学多層膜作成や大面積基板への応用を対象としている。以下のような特徴を持っている。

- 金属、酸化物など、あらゆる蒸着材料の使用が可能
- 低温での成膜が可能
- 高速反応性成膜が可能

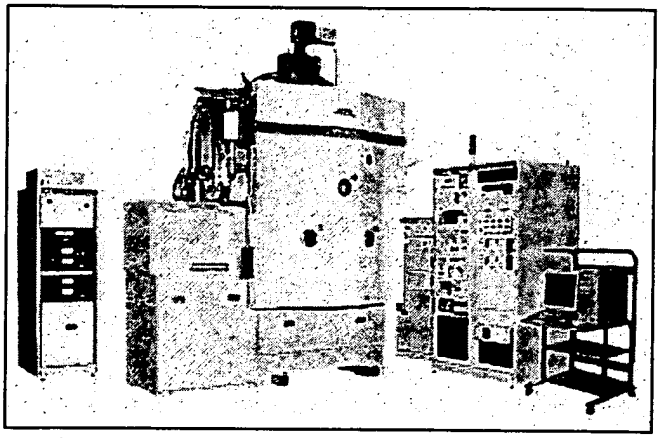
【図】

図1 イオンプレーティング装置の構造



出典:「実用真空技術総覧」、(1990年11月26日)、実用真空技術総覧委員会編、産業技術サービスセンター発行、575頁、図2．4、高周波イオンプレーティング装置

図2 イオンプレーティング装置の製品例



出典(引用情報):著者の氏名:日本電子株式会社、表題:「高密度反応性イオンプレーティング装置JEIP-900FA／JBS-1130FA」、関連箇所:1頁、写真、製品外観(高密度反応性イオンプレーティング装置JEIP-900FA／JBS-1130FA)、「online」、掲載年月日:不明、掲載者:日本電子株式会社、掲載場所:日本電子株式会社ホームページ、製品情報、半導体、成膜システム、JEIP-900FA／JBS-1130FA高密度反応性イオンプレーティング装置、検索日:2003年12月23日、情報源およびアドレス:http://www.jeol.co.jp/products/product/jeip900fa-jbs1130fa/index.htm

表1 製品例の主な仕様

蒸着室形状	ボックスコータ
蒸着室寸法（内径×高さ）	1,300φ×1,590mm
基板ホルダ	1,100φmm
ドーム	一体形
処理室 基板寸法75φmm	108枚／バッチ
拡散ポンプ（L／s）	26,000
メカニカルブースターポンプ（m^3／h）	1,200
回転ポンプ（m^3／h）	3,000
冷凍機冷却コイル（L／s） （H_2Oの排気速度）	70,000
設置室温度、湿度	20～30℃、60%以下
電源	3φ、200V、50/60Hz、110kVA
冷却水　水量 水圧、水温	155 L／min 0.25～0.35MPa、15～20℃
給水口	Rc 2
排水口	Rc 2
圧縮空気	0.4～0.6MPa
接地端子	A種接地

出典（引用情報）：著者の氏名：日本電子株式会社、表題：「高密度反応性イオンプレーティング装置JEIP-900FA／JBS-1130FA」、関連箇所：1頁、表、主な仕様（JBS-1130FA）、「online」、掲載年月日：不明、掲載者：日本電子株式会社、掲載場所：日本電子株式会社ホームページ、製品情報、半導体、成膜システム、JEIP-900FA／JBS-1130FA高密度反応性イオンプレーティング装置、検索日：2003年12月23日、情報源およびアドレス：
http://www.jeol.co.jp/products/product/jeip900fa-jbs1130fa/index.htm

【応用分野】

ミラーや光学フィルタなどの光学多層膜作成

【出典／参考資料】

出典：「実用真空技術総覧」、（1990年11月26日）、実用真空技術総覧委員会編、産業技術サービスセンター発行、572頁～579頁

出典（引用情報）：著者の氏名：日本電子株式会社、表題：「高密度反応性イオンプレーティング装置JEIP-900FA／JBS-1130FA」、関連箇所：1頁、「online」、掲載年月日：不明、掲載者：日本電子株式会社、掲載場所：日本電子株式会社ホームページ、製品情報、半導体、成膜システム、JEIP-900FA／JBS-1130FA高密度反応性イオンプレーティング装置、検索日：2003年12月23日、情報源およびアドレス：http://www.jeol.co.jp/products/product/jeip900fa-jbs1130fa/index.htm

▲ページの先頭へ

TRANSLATION OF ENCLOSED REFERENCE MATERIAL

1-6-3 Ion Plating

[Technology Classification]

1-6 Vacuum Deposition Apparatus

[Name of Technology]

1-6-3 Ion Plating

[Content of Technology]

Ion plating is combined technology of vacuum deposition and plasma. Ion plating is the technology of using gas plasma in principle to make a part of evaporated particles ions or excited particles, activate and deposit them. Accordingly, reactive ion plating, which uses the plasma of reactive gas and associates it with evaporated particles to combine a compound film, is extremely effective. As the operation is in plasma, the primary requisite is to have stable plasma, and low-temperature plasma by means of weakly-ionized plasma in the area of low pressure gas is frequently used.

Fig. 1 shows the structure of an ion plating apparatus. The ion plating apparatus features having both a plasma generating device by electric discharge and an evaporation source. Apparatuses are roughly classified into a direct current excitation type and a high frequency excitation type by a means for causing electric discharge, and besides, there are apparatuses using a hollow cathode or ion beams in an evaporating mechanism.

Fig. 2 shows an example of a product of the ion plating apparatus. The apparatus is incorporated with a

plasma beam source and can form a film using the electron beam excited plasma of high density and high efficiency. Particularly, the apparatus is directed to an application to the formation of an optical multilayer film such as a mirror or an optical filter for use under a severe condition and to a large area substrate. The apparatus has features as follows.

・All evaporation materials of metal, oxides and the like may be used.

・A film can be formed at low temperature.

・High-speed and reactive formation of a film can be performed.

[Drawing]

Figure 1 the structure of an ion plating apparatus

(In Figure 1, ① ·· substrate, ② ·· plasma, ③ ·· RF coil, ④ ·· gas, ⑤ ·· matching box, ⑥ ·· exhaust, ⑦ ·· high-frequency oscillator)